

Anthropometric study on the nasofrontal angle in human skulls

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Summary:

Background: The nasofrontal angle is the angle between the forehead & dorsum of the nose, it is of prime importance in giving the shape of the nose in relation to face. Workers studied this angle in living individuals, in this work, the angle was measured on dry human skulls, in addition, its value was statistically correlated with certain facial parameters.

Objectives: Determination of the value of nasofrontal angle in human skulls & correlation of this value to other facial parameters, namely; length of nasal bone, nasion height & midfacial length as these parameters are important for surgeons working in rhinoplasty.

Methods: The nasofrontal angle & other facial parameters were measured carefully on dry human skulls, their values were recorded & statistical correlation between them was performed.

Results: Nasal bone length showed a strong correlation with the values of nasofrontal angle, nasion height & midfacial length.

Conclusion: Nasal bone length may play an important role in determination of other facial parameters & may play a role in the indications for rhinoplasty.

Keywords: Nasofrontal angle, nasal bone, midfacial length, nasion

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Introduction:

The nasofrontal angle is located between a line drawn from the nasion (root of the nose) tangential to the glabella and a second line from the same point tangential to the nasal tip. The latter can be tangential to the nasal dorsum as well (Figure 1). A normal nasofrontal angle is 130 ± 7 degree in men and 134 ± 7 in women. (1) Nasofrontal angle has a special concern in rhinoplasty. The position of this angle can affect the shape of the nose & midfacial length in profile view. A high radix makes the nose appears too long while a low radix makes the illusion of a short nose. (2)

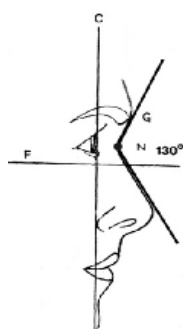


Figure 1: The nasofrontal angle (2)

Embryology: Facial development occurs mainly between the fourth and eighth weeks of gestation, five facial primordia appear early in the fourth week around the large primordial stomodeum, the single frontonasal prominence, the paired maxillary

prominences & the paired mandibular prominences, these five facial prominences are active centers of growth in the underlying mesenchyme. (3) The frontonasal prominence (FNP) surrounds the ventrolateral part of the forebrain, it will form the forehead & nose, the maxillary prominences will form the upper cheek regions and the upper lip while the mandibular prominences give rise to the chin, lower lip, and lower cheek regions. (4) **Osteology:** The forehead consists of the frontal bone, which also forms the superior part of the rim of each orbit. Just superior to the rim of the orbit on each side are the raised superciliary arches. These are more pronounced in men than in women & between these arches is a small depression (the glabella). In the nasal region the paired nasal bones articulate with each other in the midline, and with the frontal process of maxilla laterally. Superiorly, they articulate with the frontal bone, the center of the frontonasal suture formed by this articulation is the nasion. (5) The nasion is related to a distinctly depressed area (bridge of nose), it is one of many craniometric points that are used radiographically in medicine (or on dry crania in physical anthropology) to make cranial measurements, compare and describe the topography of the cranium, and document abnormal variations. Inferior to the nasal bones is the pear-shaped piriform anterior nasal aperture through which the bony nasal septum can be observed, dividing the nasal cavity into right and left parts & being formed by the perpendicular plate of ethmoid (above) & vomer (below). (6) **The nasion:** The nasion is a depression at the root of the nose corresponding to the nasofrontal suture. The

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sellion is the deepest point of the nasofrontal angle at the intersection of forehead slope and the proximal nasal bridge. It is the soft tissue equivalent of the nasion. The radix defines the nasal root and represents where the nose has its origin from the glabella. It extends inferiorly from the nasion to the level of a horizontal line passed through the lateral canthi, & superiorly for an equivalent distance. (7) More accurately the nasion can be defined as the deepest point of the nasofrontal angle & the radix in an area centered around this point extending from the eyebrows down to the intercanthal line. (8) The position of the nasion is determined according to two aspects: the vertical position which is the vertical distance between the nasion and Frankfort line (a line from the most superior point of auditory canal to most inferior point of infraorbital rim), and the horizontal position or depth which is the horizontal distance between the nasion and glabella. (2) When the vertical position of the nasion is closer to the Frankfort line, the nose appears shorter and more projected and when this distance increases, the nose seems longer. (9) (figure 2) *The midface*: The face is divided into thirds, the upper third extends from trichion to glabella, the middle from the glabella to anterior nasal spine (subnasale), the lower from the anterior nasal spine to symphysis menti (menton). (10)

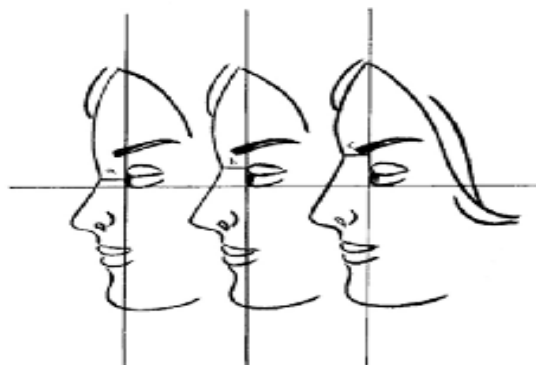


Figure 2: The nasion height
(2)

Materials & methods:

55 human mature dry skulls obtained from the Department of Anatomy, College of Medicine, University of Baghdad were used in this study. For each skull the following parameters were recorded: The nasofrontal angle was measured directly by an anglemeter, one of the two limbs of the device was placed along the glabella & the other on the dorsum of the nose, the angle was fitted on the nasion, two measurements were taken to minimize errors. In addition, each skull was photographed & the angle was measured on the photograph. The mean of the three measurements was regarded as the value of nasofrontal angle. The nasal bone length was measured by a vernier caliper, two measurements were taken, one along its articulation with its fellow & the other along its articulation with the maxilla, a mean of the two lengths was recorded as the nasal bone length. The midfacial length was also measured by vernier caliper & considered from the center of the glabella to the anterior nasal spine. Frankfort line was determined for each skull & the distance of the nasion from this line was measured by a vernier caliper & recorded as the location of the nasion. (10) Figure 3 shows the parameters measured in this work. Statistical study by using Pearson correlation coefficient was applied first to evaluate if there is any linear relation between variables, then regression curve estimation was used to analyze this relation. Data was analyzed by using SPSS for windows application (Statistical Package for Social Sciences), version 16.

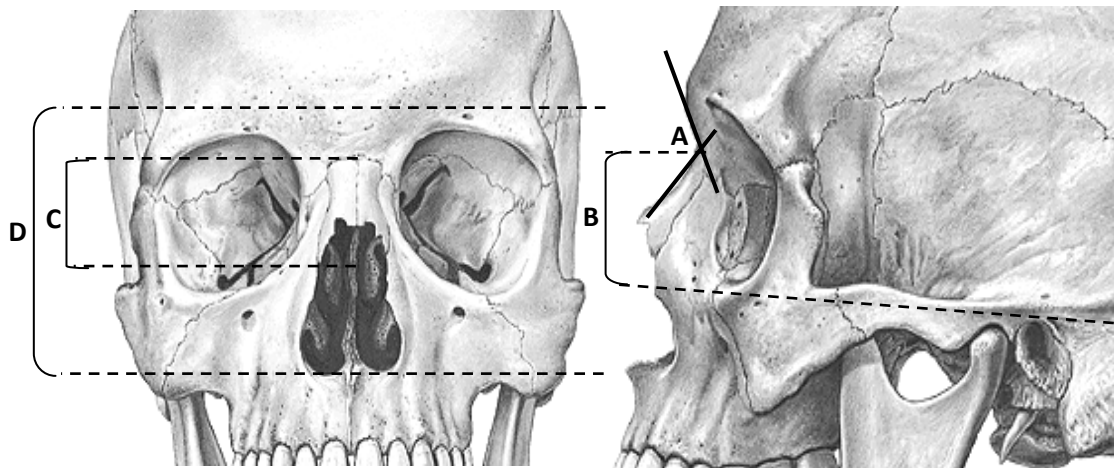


Figure 3: A- Nasofrontal angle, B- Height of nasion, C- Nasal bone length, D- Midfacial length.

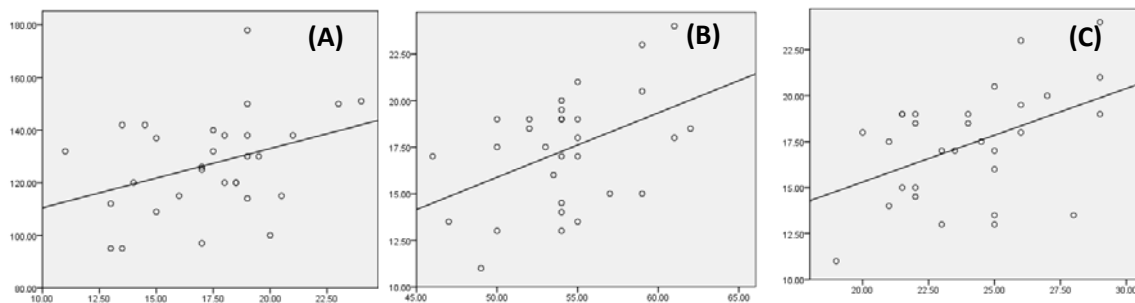


Figure 4: The relation of the length of nasal bone to nasofrontal angle (A), midfacial length (B) & nasion height (C)

Results:

The vast majority of skulls showed a nasofrontal angle between 115° - 140° , three skulls showed less than 100° angles & one showed wide angles more than 160° . The length of nasal bone also showed variations starting from 11 to 24 mm, it was longer in skulls with wide nasofrontal angle than skulls with a mean angle value. The midfacial length also showed variations ranging from 46-62 mm. The nasion height varied from 19-29 mm above Frankfort line. Table (1) summarizes the results.

Table (1): The parameter values

NF-angle		Nasal bone length		Midfacial length		Nasion height	
Rang	Mea	Rang	Mea	Rang	Mea	Rang	Mea
95-178	127	11-24	17.4	46-62	54.3	19-29	24

Statistical correlation between these parameters showed that the nasal bone length was strongly proportional to other three parameters (figure 4), P value is shown in table (2). Other parameters showed no statistical relation to each other, though midfacial length & nasofrontal angle were more proportional to each other than others (midfacial length versus nasion height, nasion height versus

nasofrontal angle), though this relation was statistically insignificant.

Table (2): (P) value for the related parameters, significance was considered below 0.05 value

Parameter 1	Parameter 2	P-value
Nasal bone length	Nasofrontal angle	0.048
Nasal bone length	Midfacial length	0.014
Nasal bone length	Nasion height	0.012

Discussion:

In the living, the mean value of the nasofrontal angle is 130° in men & 134° in women (1), on dry skulls a slightly more acute angle was determined which is 127° , facial skin & soft tissues definitely will give the living face angle more obtuse value. The ideal length of the living nose is 45-49 mm (mean 47mm) (11), nasal bone length in this work showed a mean of 17.4 mm, i.e; about 1/3 the length of the living nose, the rest of the length being formed by the cartilaginous skeleton of the nose. As the ideal length of the nose should be 2/3 the length of the midface in the living (11), it is not surprising in the results of this work to find a strong relation between the length of the nasal bone with midfacial length, as the longer the nasal bone the longer will be the nose & this will increase the midfacial length. But why

there was no relation between the midfacial length & nasion height? A probable cause is that, measuring the nasion height in this study was in relation to Frankfort horizontal line, i.e; the maxillae which form the main part of the midface were excluded which resulted in the statistically insignificant value. The same explanation could be applied for the insignificant relation between the midfacial length & the nasofrontal angle. In rhinoplasty, manipulation of the nasofrontal angle both in magnitude (by deepening or widening it) &/or in height (elevating or depressing it) is now considered in this operation in addition to other points like the nasal width, hump & nasal tip. (2). Most people subjected to this operation prefer their angle to be increased (widened) & elevated above its present position (7). This work demonstrates that the length of nasal bone is proportionally related to this angle in both aspects (magnitude & height), & therefore considering the length of the nasal bone before the operation may has an implication on the indications of this operation.

References:

- 1- Mathes SJ. *Plastic surgery*. 2nd ed. Philadelphia: PA, Elsevier; 2006.vol 2. Part 1.
- 2- Pousti SB, Jaleesi M, Asghari A. Management of nasofrontal angle in rhinoplasty. *Iranian Red Crescent Medical Journal IRCMJ*. 2010; 12(1):7-11.
- 3- Moore KL, Persaud TVN. *The developing human*. 8th ed. Saunders; 2007;179-182.
- 4- Odaci E. *Embryology. Medscape reference instant look book {Internet}*.2010. Available from:<http://www.emedicine.medscape.com>.
- 5- Drake RL, Vogl W, Mitchell AW. *Osteology*. In: *Gray's anatomy for students*. 1st ed. London. Churchill Livingstone;2004.
- 6- Moore KL, Arthur FD. *Clinically oriented anatomy*. 6th ed.Philadelphia. Lippincott Williams & Wilkins; 2010; 824-825.
- 7- Mowlavi A, Meldrum G, Wilhelmi BJ. Implications for nasal recontouring: Nasion position preferences as determined by a survey of white North Americans. *Aesth. Plast. Surg*; 2004; 27; 438-445.
- 8- Daniel RK. *The radix and nasofrontal angle*. In: *Dallas Rhinoplasty Symposium*. 1996; 331-340.
- 9- Guerrerosantos J. *Nose and Paranasal augmentation: Autogenous fascia and Cartilage*. *Clin Plast Surg*. 1991; 18;65-86.
- 10- Ridley MB. *Aesthetic facial proportions*. In: *Facial plastic and reconstructive surgery*. St. Louis: Mosby Year Book. 1992; 99-109.
- 11- Byrd S, Hobar PC. *Rhinoplasty: A practical guide for surgical planning*. *Plast. Reconstr. Surg*. 1993; 91:642.